Developing Defined and Scalable 3D Culture Systems for Culturing Human Pluripotent Stem Cells at High Densities.

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Public Summary:
Human pluripotent stem cells (hPSCs) - including embryonic stem cells (hESCs) and induced pluripotent stem cells (hiPSCs) - are very promising candidates for cell therapies, tissue engineering, high throughput pharmacology screens, and toxicity testing. These applications require large numbers of high quality cells; however, scalable production of human pluripotent stem cells and their derivatives at a high density and under well-defined conditions has been a challenge. We recently reported a simple, efficient, fully defined, scalable, and good manufacturing practice (GMP) compatible 3D culture system based on a thermoreversible hydrogel for hPSC expansion and differentiation. Here, we describe additional design rationale and characterization of this system. For instance, we have determined that culturing hPSCs as a suspension in a liquid medium can exhibit lower volumetric yields due to cell agglomeration and possible shear force-induced cell loss. By contrast, using hydrogels as 3D scaffolds for culturing hPSCs reduces aggregation and may insulate from shear forces. Additionally, hydrogel-based 3D culture systems can support efficient hPSC expansion and differentiation at a high density if compatible with hPSC biology. Finally, there are considerable opportunities for future development to further enhance hydrogel-based 3D culture systems for producing hPSCs and their progeny.

Scientific Abstract:
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